Satellite Navigation Program Update

DER Recurrent Seminar General Session

Steve Hodges
GPS Product Team Lead
Federal Aviation Administration

September 27, 2000

Commitment to Satellite Navigation

" ...the route is clearly mapped for our ultimate modernization goal and that is the transition to satellite navigation.

Satellite navigation is how we will safely and efficiently meet growing demand. GPS space navigation is the right thing to do. We know there are going to be significant benefits, and what we're focused on now is following the clear route to get us there and meeting the milestones along the way. Just as important, we've set a steady sustainable pace that will get us were we need to go."

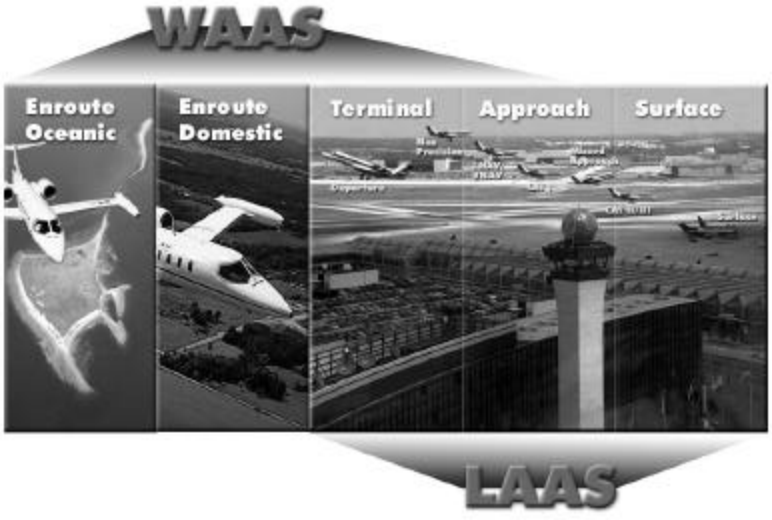
FAA Administrator Jane Garvey
ATCA Speech
September 1999

Global Positioning System (GPS)

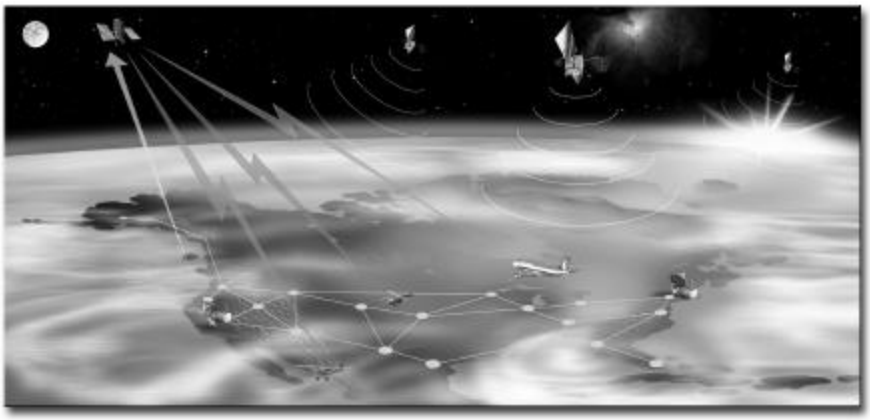
Why Satellite-Based Navigation?

- **Improved Aviation System Safety**
- **Fewer Disruptions**
- **Increased Capacity**
- **Increased Fuel Savings**
- **Low Operations Costs**
- **Low Avionics Cost**

Phases of Flight



Wide Area Augmentation System (WAAS)



- *Increased Safety*
- *Increased Efficiency and Capacity*
- *Fuel and Time Savings*
- *Cost Savings*

WAAS Levels of Service

- **Goal of WAAS Is to Provide Precision Approach Capability at All Runway Ends in the Service Volume**
  - **CONUS**
  - **Portions of Alaska**
  - **Hawaii**
  - **Portions of Caribbean**
- **WAAS Is Envisioned to Provide 3 Levels of Approach Service**
  - **Non-Precision**
  - **LNAV/VNAV**
  - **GLS**

WAAS Fielding Status

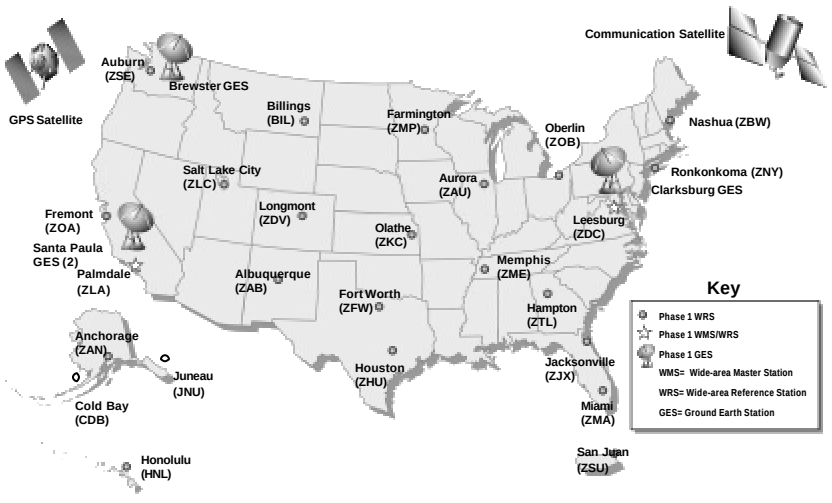
Jan 97 **INMARSAT (GEO) Lease Signed**

Jun 98 **Hardware & Communications Installed and Tested**

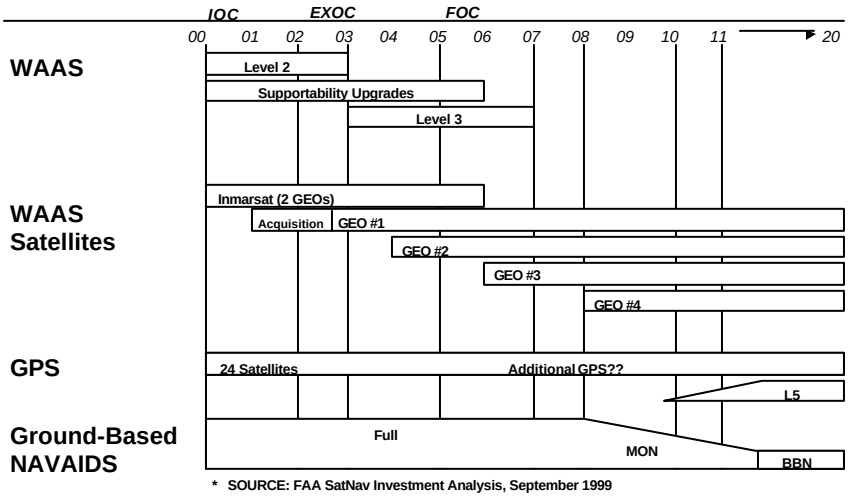
- **25 WAAS Reference Stations (WRS)**
- **2 WAAS Master Stations (WMS)**
- **2 INMARSAT Satellites**
- **Terrestrial Communications Network**

System Operating Almost Continuously Since Nov 99

WAAS Fielding Status



WAAS
High Level Schedule*



* SOURCE: FAA SatNav Investment Analysis, September 1999

Year 2000
Key Issues

- **Stability**
- **Integrity**
- **Schedule**

Stability

- **Commenced 60-day Stability Test in Dec 99**
  - **Accuracy Required: 7.6 Meters**
  - **Accuracy Demonstrated (Vertical): 2-3 Meters**
    (Horizontal): 1-2 Meters
- **Test Halted After 30 Days Due To 100 Minute Cumulative Signal Loss**
- **21-Day Retest Completed - Jun 30, 2000**
- **Public Announcement of SIS Availability for Non-Safety Applications - Aug 24, 2000**

Integrity

- **Meeting FAA Integrity Requirement (Safety) is Now Most Significant Schedule Driver**
- **Integrity Requirements (Precision Approach)**
  - **10^{-7}/Approach**
  - **Time to Alarm: 6 Seconds (Threshold), 5.2 Seconds (Objective)**
- **No Change to Integrity Requirement Since Program Definition**
- **Analysis Indicates Integrity Monitors Do Not Work Correctly**
  - **3 HMI Events Not Detected by Safety Monitor**

FAA Response to Integrity Issue

- **FAA Formed WAAS Integrity Performance Panel (WIPP)**
  - **FAA Established Team of Experts in January 2000 To Work Closely With Raytheon to Identify Most Cost-Effective and Expedient Solution**
  - **Team Includes FAA, MITRE, Stanford University, Ohio University, JPL**
  - **WIPP Actions:**
    - **Identified a Path to Achieve LNAV/VNAV Integrity**
    - **Will Identify Migration Path to GLS By December, 2000**
- **FAA Requested Independent Review Board (IRB)**

User Support

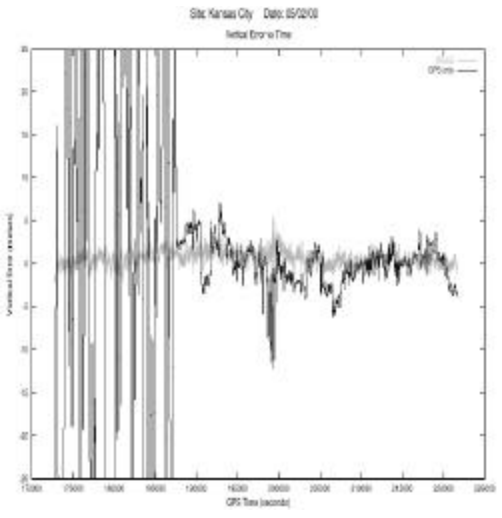
- **SatNav Summit Meeting (March 15, 2000)**
  - **Attendees Included US Domestic Users, Satellite Navigation Users Group (SNUG), FAA, DOT, DoD, etc.**
  - **NAS Users Support WAAS**
  - **Agreed to LNAV/VNAV Capability As First Step**

Program Decision Points

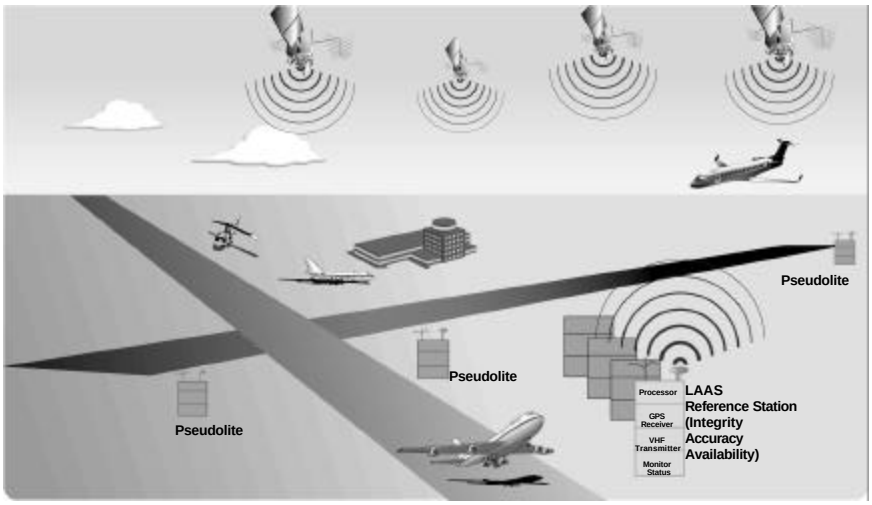
- **FAA Will Continue Work To Commission LNAV/VNAV Capability First. Goal is:**
  - **95% Availability Over More Than 50% of CONUS**
  - **Commissioning of En Route and Non-Precision Capability First Would Result in Additional Program Cost and Schedule Impacts**
- **Decision to Continue Program to GLS Capability Will Occur in First Quarter CY 01**
- **Decision If and When to Acquire Additional GEO Capability Awaiting LNAV/VNAV and GLS Decisions**

WAAS and SA

- **Primary Mission of WAAS Is to Provide Accuracy and Integrity**
- **Removal of SA Improves Accuracy, Does Not Affect Integrity**
- **Even Without SA, GPS Alone Does Not Meet GLS Requirements**

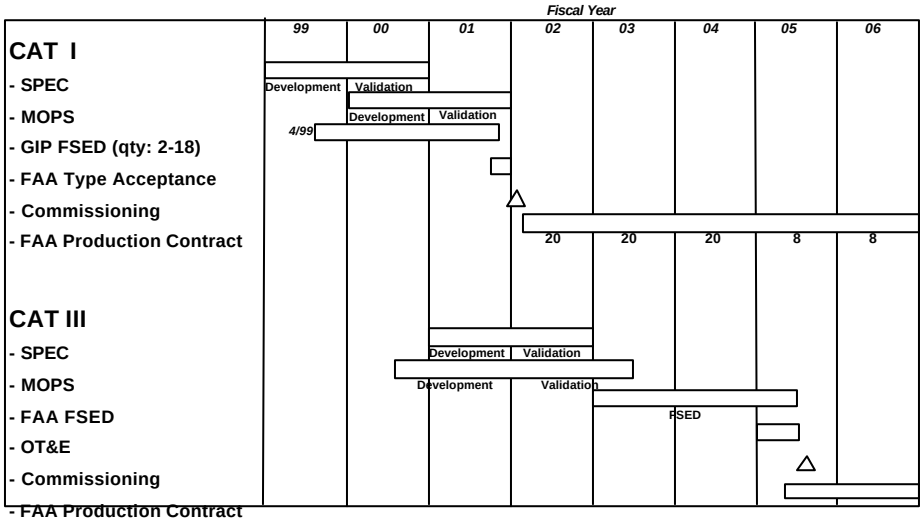


Local Area Augmentation System (LAAS)
Architecture



FAA 274-27

LAAS Program Schedule



Goals/Proposed Work
FY 01

- **Complete Activities on GIP CAT I/Type Acceptance**
- **Acquisition Planning/Develop RFP for CAT I Production Contract**
- **CAT II/III Spec Development and Validation**
- **CAT II/III MOPS Development and Validation**
- **NAS Implementation/Fielding Prep**
  - **Airport Surveys**
  - **Complex Procedures**
  - **CBI Training**
  - **TERPS**
  - **Receiver Development**
  - **Procedures/Flight Inspection**

Goals/Proposed Work
FY 02

- **CAT I LAAS Production and Fielding**
- **Complete and Validate CAT II/III Specification**
- **Complete CAT II/III MOPS Validation**
- **Develop Request for Procurement for CAT II/III FSD**
- **NAS Implementation**

Summary

- **FAA is Committed to the Transition to Satellite Navigation**
- **Aviation Users Support Continued FAA Development of WAAS**
- **WAAS is an Operating, Stable System**
  - **Integrity Issues Prohibit Aviation Safety Use**
  - **SIS Available for Other Uses**
- **Meeting Integrity Requirement Most Difficult Programmatic Issue and is Schedule Driver**